REMARKS

Entry of the foregoing and reconsideration of the subject application are respectfully requested in light of the amendments above and the comments which follow.

Claims 1 and 3-20 were pending in this application.[1] In this response, claims 7, 9 and 11 have been amended and claims 21-27 added. Thus, claims 1 and 3-27 remain pending. Claims 7, 9 and 11 have been amended to remove nested ranges, which have been represented as new claims 21-27.

Support for the foregoing amendments can be found, for example, in at least the following locations in the original disclosure: the original claims and the specification, page 5, lines 7-14; page 6, lines 3-12; and page 10, lines 6-14.

REJECTIONS UNDER 35 U.S.C. § 103

Claims 1-19 are rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,435,780 to Flynn (hereafter "*Flynn*") on the grounds set forth beginning at page 2 of the Official Action. These rejections are each respectfully traversed.

In an embodiment of Applicants' invention, cutting edge 10 includes an outer cutting edge 12, which makes an angle α_1 with the direction of the rotation axis L and which is limited at the inside by a lower limit 13, which is the lowest point of the cutting tooth 5. Inside the lower limit 13 the cutting edge 10 includes an inner cutting edge 14 which makes an angle α_2 with the direction of the rotation axis L. Thus, inner cutting edge 14 and outer cutting edge 12 slope in

[1] The prior response submitted on February 17, 2009, canceled claim 2 and added claim 20. Accordingly and to the extent the rejections are applied to all of the previously pending claims, i.e., claims 1-19, Applicants will consider

opposite directions. As the counteracting forces imparted from the workpiece on the cutting tool at the cutting edges thereof are acting on both sides of the lower limit 13 and thus have opposite directions, the resulting force on the cutting tooth 5 in the plane perpendicular to the rotation axis L is reduced, so that the tool is more stable during cutting.

In the Official Action, the Examiner acknowledges that *Flynn* does not disclose the claimed cone angle and then asserts that it would have been obvious to provide a cone angle larger than 65°, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. Applicants respectfully disagree.

In general, the tool in *Flynn* functions in a completely different way from that claimed in the present application and is used in a completely different way from that claimed in the present application. Thus, there is no optimization of *Flynn* that changes these dissimilarities in function and use nor is there an optimization of *Flynn* that one of ordinary skill in the art would have considered that results in the presently claimed tool. Furthermore, the proposed optimization would actually make Flynn unsuitable for its intended purpose, thus rendering the proposed modification improper. Therefore, the *prima facie* case of obviousness is without merit and should be withdrawn.

More specific arguments are present below.

Flynn desires to provide an improved end milling tool which is effective to reduce forces produced in ramp cutting. In general, end milling tools are moved along a direction perpendicular to the axis of the tool. *Flynn* considers a situation, in which in addition to the

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the rejection as applying to all of the currently pending claims as of the date of the Official Action, i.e., claims 1 and 3-20.

normal, lateral movement (perpendicular to the axis) also some axial movement of the end milling tool is provided which operation is called "ramping".

Typically, ramping angles are rather small, such as in the order of 15° or lower such as shown in Figure 5 of *Flynn*, even though in a comparison with prior art devices *Flynn* also considers ramping angles of up to 45°. However, the forces considered, according to *Flynn*, become unacceptably large and much larger than with a smaller ramping angle.

According to *Flynn* (claim 1) the desired reduction of cutting forces in ramp cutting is among others achieved by a "peripheral end edge portion sloping shallowly from the tip periphery towards the shank portion and the interior edge portion sloping relatively steeply from the peripheral end portion towards the shank portion."

The direction of slope as disclosed by *Flynn*, for both the shallowly-sloping end edge portion and the interior edge portion, may be identified as negative by definition. This results in the effect that the transition from a side cutting edge to the peripheral end edge portion is the most forward projecting tip of the tool (see, e.g., Figure 3 of *Flynn*, where the radially outermost edge is also axially mostforward). Upon ramping, this most forward projecting (radially most outward) tip actually "grips" into the work piece and substantial repelling forces tending to bend the tool backwards and away from the lateral feed direction are thereby avoided.

Flynn discloses that the repelling forces are to be counteracted or overcome by means of the negative cone angle and, in particular, the steeper negative cone angle of the inner portion disclosed by *Flynn*. The Examiner suggests changing the cone angle from negative (as in Flynn) to positive (as in the present claims) is merely "a change in size". However, there is a change of sign in the cone angle of the present claims when compared to *Flynn*, resulting in a shift of the

tip of the tool towards the center, and the particular selection of relative arrangements go far beyond a mere change in size. In particular, such a positive cone angle shifts the tip of the tool first engaging the work piece in operation from the radially outmost edge towards the center of the tool, thereby causing completely different forces.

In view of this teaching, a skilled person would never consider a positive cone angle as claimed for the peripheral end edge portion in *Flynn* because such a positive cone angle would be considered to have the opposite effect than that desired and taught by Flynn and would increase any repellent force. This proposed modification alone would render the tool in *Flynn* unsuitable for its intended purpose. As such, the proposed rejection is improper. See, MPEP §2143.01 (noting that a combination of references resulting in a prior art reference being unsatisfactory for its intended purpose is improper).

Furthermore, the above understanding of *Flynn* and the negative cone angle and the repelling forces several questions whether one of ordinary skill would even had considered such a proposed modification because *Flynn* can be considered to, in effect, teach away from a positive cone angel as claimed, i.e., larger than 65°.

In other words, when starting out from the prior art as disclosed by *Flynn* and other documents, any positive cone angle of the periphery end edge portion would never be considered an optimization since the result would be a repellent force against the natural feed direction of end milling in contrast to the desired result. In other words, when starting out from the prior art of *Flynn* and considering any values of a "result effective variable" a skilled person would never arrive at a positive cone angle larger than 65°, because such an angle would not form an

optimum for the purpose and way of operation disclosed by *Flynn* and thus definitely teaches away from such a provision.

The recognition, that a positive cone angle for the peripheral end edge might have a positive effect would only be possible when further considering a completely different way of operation of a milling tool than that understood by one of ordinary skill to be associated with the tool in *Flynn*. Namely, the presently claimed method as defined in method claims 18 and 19 and as shown in the figures disclose axial movements during a cutting operation and only stepwise lateral movements out of engagement with the work piece and with a step width less than half diameter of the tool, thereby cutting only a sickle-shaped portion from a work piece by means of a merely axial feed movement. The milling tool is then at any time in engagement with the work piece only along a sickle shaped portion of its cross section which requires a new design of the cutting edges to balance the resultant cutting forces. This is different from that of *Flynn* and any optimization thereof requires the knowledge of this method of milling and even then the design of the cutting edges is not obvious. Accordingly the Examiner's arguments on obviousness are clearly based on hindsight, as one of ordinary skill in the art would not have appreciated these additional details and, therefore, could not have arrived at the solution without the advantage of hindsight analysis.

However, even if one were to know this method of milling, there should be noted that an engagement along a sickle shaped portion causes, on each turn of the rotating tool, the cutting edges to engage the workpiece first at the radially outer end thereof. The tip and radially inner parts do not engage the work piece until a certain angular position well after the first engagement position has been reached (this can be recognized based on Figures 7 to 9). In other words, even

under this way of operation, the particularly claimed arrangement and design of the cutting edges would still not be obvious in view of *Flynn*, because the resulting forces at a particular cutting edge are continuously changing during operation. Thus, a positive cone angle of any peripheral edge (as taught in *Flynn*) would not properly work with drilling only sickle-shaped portions from a workpiece, because the cutting edge design of ordinary drilling tools such as *Flynn* would then tend to generate very large lateral, unbalanced bending forces which even might cause the drill to break. For this further reason, *prima facie* obviousness has not been established and the rejections should be withdrawn.

In principle, the client would be ready to enter further restrictions from the dependent claims, such as a range of the circle for the forward projecting tips of the cutting edges 0,6 D and 0,8 D and also the cone angle from 75° to 87° or if necessary even from 77° to 87°. However, we understand from a way of arguing and the present official action, the examiner might consider these further restrictions to be "an obvious matter of design choice".

Claim 1 recites "the cutting edges comprise inner cutting edges laying on a first surface of revolution which is in the first direction higher at a larger diameter and lower at a smaller diameter", "at a diameter larger than the inner cutting edges outer cutting edges are laying on a second surface of revolution which is in the first direction lower at a larger diameter and higher at a smaller diameter" and "a cone angle α1 is larger than 65°." Support for claim 1 is provided at, for example, page 5, lines 7-24, and Fig. 4 of Applicants' specification. In an embodiment of Applicants' invention, cutting edge 10 includes an outer cutting edge 12, which makes an angle α_1 with the direction of the rotation axis L and which is limited at the inside by a lower limit 13, which is the lowest point of the cutting tooth 5. Inside the lower limit 13 the cutting edge 10 includes an inner cutting edge 14 which makes an angle α_2 with the direction of the rotation axis L. Thus, inner cutting edge 14 and outer cutting edge 12 slope in opposite directions. As the counteracting forces imparted from the workpiece on the cutting tool at the cutting edges thereof are acting on both sides of the lower limit 13 and thus have opposite directions, the resulting force on the cutting tooth 5 in the plane perpendicular to the rotation axis L is reduced, so that the tool is more stable during cutting.

In contrast, as described at col. 3, lines 3-21, and illustrated in Fig. 3, Flynn discloses a end cutting edge 20 including two portions- peripheral end edge portion 70 and interior edge portion 72. Peripheral end edge portion 70 slopes relatively shallowly toward shank portion 14 from the tool periphery to interior edge portion 72. Angle 74, defining the slope of peripheral end edge portion 70, is typically 2-5 degrees. Interior edge portion 72 slopes relatively steeply

toward shank portion 14 from end edge portion 70 to intersection with gash 46. Angle 76, defining the slope of interior portion 72, is in the range of 5-25 degrees. Thus, peripheral end edge portion 70 and interior edge portion 72 slope in the same direction.

Accordingly, Applicants submit that Flynn does not disclose at least the features of "the cutting edges comprise inner cutting edges laying on a first surface of revolution which is in the first direction higher at a larger diameter and lower at a smaller diameter", "at a diameter larger than the inner cutting edges outer cutting edges are laying on a second surface of revolution which is in the first direction lower at a larger diameter and higher at a smaller diameter" and "a cone angle $\alpha 1$ is larger than 65°," as recited in claim 1.

Claims 3-19 depend from claim 1 and recite the same combination of allowable features recited in claim 1 as well as additional features that define over the applied art. Accordingly, Applicants respectfully request that the rejection under 35 U.S.C. § 102(b), of claims 1, 3-5, 8, 10, 12 and 13, and the rejection under 35 U.S.C. § 103(a), of claims 6, 7, 9, 11 and 14-19, be withdrawn and the claims allowed.

Applicants have added new claim 20. Support for new claim 20 is provided at, for example, page 5, lines 34-36 of Applicants' specification. Examination of new claim 20 is requested.

CONCLUSION

From the foregoing, further and favorable action in the form of a Notice of Allowance is earnestly solicited. Should the Examiner feel that any issues remain, it is requested that the undersigned be contacted so that any such issues may be adequately addressed and prosecution of the instant application expedited.

EXCEPT for issue fees payable under 37 C.F.R. § 1.18, the Commissioner is hereby authorized by this paper to charge any additional fees during the entire pendency of this application including fees due under 37 C.F.R. § 1.16 and 1.17 which may be required, including any required extension of time fees, or credit any overpayment to Deposit Account No. 50-0573. This paragraph is intended to be a **CONSTRUCTIVE PETITION FOR EXTENSION OF TIME** in accordance with 37 C.F.R. § 1.136(a)(3).

Respectfully submitted,

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Date: August 6, 2009

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